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Assessing the Impact of Persistent Identifiers (PIDs) in Building Trust in Research and Science: A Case of Three Zimbabwean Universities

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Abstract: *Intellectual property ownership is a serious issue, particularly when authors share the same names, making it hard to identify rightful owners. This obstacle extends to research institutions with similar acronyms, undermining trust in research and science. The study aimed at assessing the benefits and opportunities of persistent identifiers in addressing current research challenges. Persistent identifiers were invented to address challenges arising from the disorganised nature of the internet, which often resulted in URLs to internet endpoints becoming invalid which is called link rot, Huber (2016). Later on however it becomes interesting to note the role that they now play in research. The data collection instrument was a structured online questionnaire, using a quantitative methodology and a descriptive cross-sectional survey design. A stratified random sampling technique targeted individuals engaged in research and scholarly communication at three selected Zimbabwean universities. The Pilot Testing phase was essential for identifying and addressing weaknesses in the instrument, enhancing its validity and reliability before full deployment. The study's findings align with the literature, revealing the diverse benefits of Persistent Identifiers, such as improved citation practices, increased research visibility, and enhanced networking opportunities. The conclusion emphasized that the recognition of PIDs benefits and implementation challenges calls for coordinated action to enhance research visibility, trust, and collaboration. The recommendations require institutional leadership, targeted resource allocation, and collaboration with research communities.*

Keywords: *Intellectual Property, Persistent Identifiers, Research Visibility, Citation Practices, Scholarly Communication, Research integrity*

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1. Introduction

The integrity and credibility of scientific communication are vital. Maintaining integrity in research fosters trust and confidence in both the research process and its outcomes. It enables researchers to share information, cultivate ideas, and produce high-quality data. Additionally, accountability and transparency are essential in scholarly communication. Disambiguation - distinguishing between similar or identical works - ensures that researchers receive appropriate credit for their contributions, and those users can accurately find resources. In light of these factors, the study will examine how persistent identifiers can enhance these aspects and assist research institutions and individual researchers in their efforts. Australian research data commons ARDC define Persistent identifiers as a label which gives a unique name to an entity: a person, place, or thing. Unlike URLs, which may break, *a* persistent identifier reliably points to a digital entity. An ORCID ID is an example of a persistent identifier for individual researchers.

Persistent identifiers (PIDs) have existed for over two decades and are now a well-established method for identifying literature and data online. They were created to solve the problem of "link rot," where web links become inactive, undermining the integrity of the digital scientific record. While some believed that proper web server management could eradicate this issue, recent research continues to emphasize the importance of distinguishing between an object's identity and its location on the internet Modern internet architectures increasingly recognize the limitations of using a single address for both identity and location. The Identity and Location Separation (ILS) network architecture explicitly decouples these functions, improving routing scalability and mobility. Recent advancements, such as systems built on programmable data planes, are making large-scale deployment of ILS more feasible, addressing previous performance and proprietary limitations, Lianpeng Fu and Kuayue Chen (2023).

Since then, various PID systems have been developed, and their effectiveness in managing the scientific record has been assessed by Duerr et al. (2011) and Klump and Huber (2017). Barnes and Cole (2024) highlight that link rot affects all parts of the web, but it's especially important for scholarly records. It impacts our ability to build on previous work, verify results, and trace the origin of ideas and research. Around 60-70% of links fail to work after 10 years. A recent analysis of CrossREF DOIs showed a 97% success rate, meaning 3% still didn't resolve. These findings have significant implications for the archiving and long-term accessibility of books and research materials.

The issue of authorship and ownership of research outputs presents a significant dilemma, particularly when intellectual property producers and research institutions share similar names, surnames, and acronyms. This overlap can undermine research credibility and create confusion regarding the true origin of the work. There is a growing recognition of the gap in the publishing field in Zimbabwe, leading to efforts to incorporate persistent identifiers as a standard for researchers and research institutions.

Though created to manage the challenge of link rot, persistent identifiers have grown far beyond that and now serve many different purposes as the paper will further deliberate on how they are being perceived in Zimbabwe. Since the introduction of the Handle System, Persistent identifiers (PIDs) have found applications beyond just literature and data have found. Medows and Haak (2018) writing about how persistent identifiers can save scientists indicate that they can now be used to identify gene sequences, proteins, specimens in scientific collections, individual researchers, research grants, and various other emerging applications.

While some PID systems have become integral to the scientific information infrastructure, other areas are still developing, with new use cases continuously being developed. Identifiers like Open Researcher and Contributor Identifier ORCID, identify individual researchers whilst Digital Object Identifiers identifies research institutions.

Meadows, Haak and Brown (2023) indicate that persistent identifiers also bring about many crucial elements that are of paramount importance to research. Issues of collaboration in research are of paramount importance especially in developing nations and persistent identifiers also happen to promote them. Issues of visibility of researchers are also easily tackled and researchers and institutions that do research are made visible through incorporation of PIDs.

As a result, there are organisations formed mainly for such purposes. A good example being Data Cite and any more that will be discussed below. Data cite mainly Connects Research and advance Knowledge through production of Digital Object Identifiers (DOIs). It is a global community that shares a common interest: to ensure that research outputs and resources are openly available and connected so that their reuse can advance knowledge across and between disciplines. Data cite also helps in the adoption of best practices in research e.g. FAIR principles, Thus Findability Accessibility Interoperability and Reusability of knowledge.

Persistent identifiers can also be used as anchor points in the semantic web and thus aid discovery of research resources. When semantic reasoning is applied not only to concepts in linked data but is applied to concrete identifiable objects, persistent identifiers are crucial for unambiguous identification of these objects (Güntsch et al, 2017). Furthermore, persistent identifier metadata should hold information about how they relate to other objects. This "cross-linking" has been a feature of some persistent identifier systems for more than a decade, but only now is cross-linking between identifiable objects being further developed (Mayernik et al, 2016).

While various studies, such as those by Duerr et al., (2018) have evaluated the effectiveness of PID systems at a broad level, there is a lack of context-specific research examining how these systems adapt to diverse disciplines and types of research outputs, so this research covered that gap. Different fields may have unique requirements and challenges that PIDs need to address, which have not been thoroughly explored and furthermore, PIDs are gaining traction, institutions often lack comprehensive guidelines on their implementation. This presents a hurdle for individual researchers in leveraging PIDs effectively. Investigating how institutions can provide better support and resources for researchers navigating the PID landscape will bridge this gap. The long-term impact of widespread PID adoption on research productivity, collaboration, and citation practices remains unclear. Longitudinal studies assessing these effects are needed to ascertain that indeed PIDs enhance research integrity

Understanding the nuances of PID effectiveness can directly contribute to improving research integrity and trustworthiness, fostering a more robust scholarly communication environment. On the other hand informed Policy Development is key, as such the findings can guide institutions in formulating evidence-based policies and practices regarding PID adoption and implementation, ultimately supporting researchers in their efforts. Investigating user experience and usability can lead to innovations in PID systems that are more responsive to users' needs, thereby increasing adoption rates.

1.2 Statement of the problem

Researchers or research institutions share identical names or acronyms, leading to potential confusion regarding authorship and ownership of works. This overlap can undermine the credibility of research and publishing, as it may allow individuals to mistakenly claim association with works that do not belong to them. This lack of clarity can hinder the integrity of academic discourse and the verification of contributions within the scholarly community.

Watts (2021) describes how PIDs, such as ORCID and ROR, uniquely identify researchers and institutions, reduce confusion from name similarities, and increase the completeness, accuracy, and trustworthiness of research records

Given these factors, the study aims to assess how the implementation of PIDs influences trust in research works among various stakeholders, including researchers, institutions, and the public. It will explore the perceptions of trustworthiness associated with PIDs and examine their role in enhancing the credibility of scientific communication.

1.3 Research Questions

1. What is the role of the universities administration in promoting awareness and adoption of PIDs?
2. What are the opportunities and or benefits that universities could benefit from, by using PIDs?
3. What challenges have been faced in the adoption of persistent identifies?
4. How can these challenges be mitigated?

2. Literature Review

2.1 Role of University Administration in Promoting awareness and adoption of PIDs in African Universities

University administrations may play a crucial role in promoting the adoption of persistent identifiers (PIDs) in African universities through policy development, infrastructure support, training, and collaboration. Okonkwo (2020), in his work on establishing institutional policies for data management in African universities, emphasizes the need for structured policies to manage research data effectively. He highlights that proper data management can enhance research quality and visibility, facilitating better access to scholarly outputs.

Eze, (2021) states that administration can facilitate programs for faculty and researchers on the importance and use of PIDs, thus through training and capacity building a lot can be achieved. Resource Development creating educational materials, such as guides and manuals can support faculty and researchers in understanding how to use PIDs effectively. These resources can be made available online for easy access.

Establishing mentorship programs where experienced researchers guide their peers in adopting PIDs can foster a culture of collaboration and knowledge sharing within the institution as well as Integration into Research Workflow

Training can emphasize how to seamlessly integrate PIDs into existing research workflows, making it easier for researchers to adopt these practices without disrupting their current processes**,** Osunade, (2022)**.**

It is also critical for universities to Promote Open Access or open scholarship. Encouraging open access policies that integrate PIDs can enhance the visibility and impact of research, Chisenga, (2016)**.** Promoting of open scholarship also promotes Best Practices: By highlighting successful case studies and best practices from other institutions, administrations can inspire faculty and researchers to adopt PIDs and enhance their own research outputs. Encouraging Interdisciplinary Collaboration Monitoring and Evaluation Regular assessments of training programs can help administrators identify areas for improvement, ensuring that the training remains relevant and effective in meeting the needs of researchers.

By actively promoting training and capacity-building programs related to persistent identifiers, university administrations can significantly enhance the research capabilities of faculty and researchers. This investment in education not only improves individual research

practices but also contributes to the overall advancement of the institution's research profile, fostering a culture of excellence and innovation in academic inquiry.

2.2 Benefits and opportunities of Using PIDs in Universities

Persistent Identifiers (PIDs) provide several huge benefits in academic settings, primarily cantered around interoperability, enhanced discoverability, and access to rich metadata, as highlighted by Car et al. (2017). Major advantages include: **Interoperability and Trust**: PIDs function as a socio-technical infrastructure that fosters a community of users essential for their credibility. Open-source solutions and open data contribute to building reliability and trust among users, as emphasized by Bilder et al. (2015). Researchers believe that trust in organizations is often more crucial than the technological aspects of PIDs.

2.1.2 Economic Impact

The Australian Research and Data Commons (2021) indicates that implementing PIDs could lead to significant cost savings—projected at over £5.67 million for UK universities—by establishing a national PID support consortium. This financial benefit arises from improved efficiency in managing research outputs. **Support for Research**: PIDs provide stable links to diverse research outputs, including journal articles, datasets, and grey literature. This stability enhances citation, attribution, and discovery of research materials, forming a vital infrastructure for future research initiatives. **Reducing Administrative Burden**: Utilizing PIDs can automate processes such as metadata management, alleviating the time researchers spend on administrative tasks—an average of over 25% of their time, as noted by Nature (2016). For instance, systems like Cross ref allow for automatic updates to researchers' profiles based on metadata provided by publishers.

2.3 Benefits for Researchers and Institutions

For researchers, adoption of PIDs can lead to time savings and reduced errors due to the seamless integration of identifiers across systems. For example, ORCID integration in grant applications has enhanced data sharing and reduced redundancies.

Enhancing Recognition: PIDs facilitate proper attribution of diverse contributions, which is increasingly recognized in citation-based evaluation systems. They help ensure that work is credited appropriately, even in novel formats like open peer reviews.

Facilitating Collaboration: PIDs such as ORCID promote collaboration by ensuring accurate recognition and tracking of contributions across institutional and geographic boundaries. They help in connecting related research outputs, which bolsters overall understanding of research topics.

Data Management support: Assigning DOIs to datasets enables researchers to maintain control over their data, ensuring accessibility and interoperability. This practice aligns with the FAIR principles—making research data Findable, Accessible, Interoperable, and Reusable—which promotes data sharing.

Research Impact tracking: PIDs are valuable for monitoring research impact through metrics such as citations and downloads. These insights guide researchers in making informed decisions regarding focus areas and collaboration opportunities.

Knowledge preservation: PIDs maintain the integrity and accessibility of research outputs over time. Their use ensures that scholarly records are preserved, supporting continuous advancement in knowledge.

2.3.1 PIDs in Australia: A` time-saving research infrastructure

Countries like Australia are working on national PID strategies to significantly enhance efficiency and effectiveness in managing research outputs. Natasha Simons from ARDC underscores the importance of national identifier infrastructure in maximizing research value. As more entities consider establishing similar strategies, the benefits of PIDs are expected to expand significantly.

As noted by Meadow, Haak, and Brown (2019), PIDs serve as crucial connectors in the research ecosystem, enabling clear identification of researchers and their contributions. The ongoing conversation surrounding the implementation of PIDs points the need for strategic planning and collaboration across various research communities to unlock their full potential.

The adoption of PIDs not only streamlines processes for individual researchers but also enhances institutional and community engagement in the broader academic spheres. This collaborative approach is essential for ensuring the sustainability and efficacy of research efforts in the future.

2.4 Challenges associated with use of PIDs

The fragmentation of the PID implementation environment presents a significant risk, as noted by De Castro et al. (2024). Various organizations across different countries are engaged in parallel activities that often lack communication with each other. Currently, there are no dedicated events for comprehensive

discussions on PIDs, leading to conversations scattered across unrelated forums.

Despite the existence of certain dedicated forums, such as EOSC-funded projects like FAIRCORE4EOSC and events organized by the Research Data Alliance (RDA), the fragmentation is most evident in three areas: **Technical vs. Admin-oriented PIDs**: A distinction exists between those focused on technical attributes and those that are more administratively oriented. **Conflicting Standards**: The diversity of conflicting technical solutions further complicates PID implementation. **Stakeholder Complexity**: The involvement of numerous stakeholders adds another layer of difficulty to the community-driven PID implementation process.

These barriers prevent many institutions in regions like Asia and Latin America from adopting DOIs, while alternatives like Handles and ARKs offer more affordable solutions. Initiatives, such as DataCite's Global Access Fund, have been recognized as insufficient in addressing underlying financial challenges.

In Latin America, funding challenges are significant, as highlighted by CORE (2023). Only 20% of the more than 4.5 million metadata records gathered by LA Referencia from Latin American publications and libraries include DOIs. Similarly, Africa faces analogous financial barriers, with collaborative efforts like the Africa Connect project aimed at developing open access publishing and data sharing.

2.4.1 Risk of Monopolization

The risk of monopolization may be more troublesome than the cost issue, as noted by CORE (2023), This quasi-monopolistic scenario would disproportionately empower a few entities and could lead to financial exploitation. The reputational risk involved in linking DOIs to research integrity is particularly concerning for developing regions, as many of their outputs might not meet such DOI standards, worsening visibility and credibility issues.

2.5 Mitigation to challenges faced in the use of PIDS

Dappert etal (2017) argue for a resilient, diverse PID ecosystem, emphasizing that "there is not a reductionist drive for a single PID solution or registry. This diversity adds strength to the PID ecosystem," and that open, interoperable infrastructures are preferable to centralized, exclusive models.

Furthermore, the various PID types should be harmonized to avoid creating isolated metadata silos, ensuring interoperability. As noted in the UNESCO Open Science Toolkit, an open, long-term infrastructure for research that allows equitable participation is critical.

COAR supports a distributed yet interoperable environment for PID implementation, advocating for robust community-managed infrastructures. Ensuring these infrastructures meet the needs of all stakeholders, this is crucial for fostering a resilient research community.

2.5.1 Programs assisting Lower resourced Nations

CORE (2023) states that Substantial cost barriers to the adoption of DOIs for organizations especially in developing countries. The costs of joining DOIs (or Data Cite or Crossref even as a consortium) makes them unaffordable in many parts of Africa, Asia, and Latin America, where there is often little funding for such services. In addition, fluctuating currency exchange rates in many countries mean the future costs can be highly unpredictable. Although all PIDs require some resources to maintain them or they are at risk of becoming inactive not accessible. Some PIDs, such as Handles and ARKs, are far less expensive to acquire. There are programs to assist lower resourced countries (such as the Global Equitable Membership program at Crossref or the Global Access Fund from Datacite), these programs however provide only temporary or partial relief and do not address the fundamental financial constraints for many organizations. The Datacite Global Access Fund, for example, will offer registration of DOIs free of charge for a year, and then organizations should then provide a sustainability plan outlining how they plan to continue accessing these services following the funding period. This is not a long term solution, but rather merely enticing organizations to join, leaving them to confront the cost issue once the year is over. The Crossref Global Equitable Membership program offers waivers for organizations in some low income countries, but it covers only a subset of the countries and institutions that are facing serious financial problems.

Discoverability and persistence are critical for making research widely accessible and impactful, but this must be done in a flexible manner that addresses the needs of the entire scholarly community while minimizing inequalities. Instead of relying on a few central Digital Object Identifiers (DOIs) services that may exclude many due to costs, institutions and regions should choose the Persistent Identifier (PID) services that work best for their local situations to promote wider adoption. Although there might be advantages to using only a couple of global PID services, this could create divides between those with access and those without. Using different types of PIDs can still be effective if metadata across these services is harmonized, allowing for better interoperability and a more inclusive scholarly environment. The UNESCO Open Science Toolkit emphasizes the importance of developing long-term

structures and funding to ensure that researchers from less privileged backgrounds can participate equally in the scientific community, CORE (2023).

3. Methodology

Quantitative research methodology employed in this study to assess the impact of Persistent Identifiers (PIDs) on fostering trust in research and science within three Zimbabwean universities. It comprehensively details the research design, population definition and sampling strategy, data collection instruments and procedures, variable operationalization and measurement, data analysis techniques, and ethical considerations. This structured quantitative approach was designed to systematically measure the current state of PID adoption, perceived benefits, encountered challenges, and the role of university administration, specific uses, and emergent opportunities. The primary aim was to generate statistically generalizable insights relevant to the Zimbabwean higher education research context De Castro et al., 2024; CORE, (2023).

3.1 Research Design

A descriptive cross-sectional survey design was adopted for this study. This design is particularly suitable for quantitatively describing the current status and characteristics of PID adoption, usage patterns, and stakeholder perceptions within the target population at a specific point in time, providing a representative "snapshot" Creswell & Creswell, (2018). Furthermore, it facilitated the identification of potential relationships between variables, such as the correlation between perceived benefits and the level of PID adoption, or the association between administrative support mechanisms and the challenges faced. The design enabled the generalizability of findings to the broader population of academic staff, researchers, librarians, and administrators engaged in research and scholarly communication within the participating universities.

The target population for this study comprised of individuals actively involved in research activities and scholarly communication processes within the three selected Zimbabwean universities. This encompasses distinct stakeholder groups: Academic Staff and Researchers (including Lecturers, Senior Lecturers, Professors, and Research Fellows); Librarians (such as Subject Librarians, Repository Managers, and Scholarly Communication Specialists); Research Administrators (including Heads of Departments, Deans of Research, and Research Office Staff); and ICT Support Staff relevant to research infrastructure management.

The sampling frame was constructed using official staff lists obtained from the Human Resources departments of each university, supplemented by relevant faculty and departmental lists. To ensure representative coverage across institutions and key stakeholder roles, a stratified random sampling technique was employed Fowler (2014). The population was stratified based on two primary criteria: University affiliation (to guarantee representation from each of the four institutions) and Role Category (Academic Staff/Researchers, Librarians, Research Administrators, ICT Staff). This stratification ensured the perspectives of all key groups involved in PID usage, promotion, and management is captured. Subsequently, within each unique stratum (defined by university and role category), participants were selected randomly using a random number generator applied to the respective staff lists.

3.2 Population and Sampling Procedures

The target sample size was calculated using Cochran's formula for finite populations Cochran, (1977), targeting a 95% confidence level and a margin of error of ±5%. Anticipating a response rate between 60% and 70%, the initial sample drawn will be adjusted upwards accordingly. The final target sample size was estimated to be approximately N = 6.

3.3 Validity and Reliability

Ensuring the quality of measurement is critical. Content Validity is established by grounding all questionnaire items directly in the research objectives, the comprehensive literature review (Chapter 2), and incorporating feedback received during expert review and pilot testing. Construct Validity is addressed by employing established concepts from the literature (e.g., FAIR principles, documented PID benefits/challenges) and utilizing multiple items to measure key latent constructs (e.g., multiple Likert items forming a "Benefits" scale). Exploratory Factor Analysis may be conducted if the sample size permits, to further assess construct validity.

Reliability, specifically the internal consistency of multi-item Likert scales (e.g., the Benefits scale, Challenges scale), will be assessed using Cronbach's Alpha coefficient (Cronbach, 1951). A coefficient value of $\alpha \geq 0.70$ will be considered acceptable evidence of scale reliability. The Pilot Testing phase serves as a crucial step in identifying and rectifying ambiguities or weaknesses in the instrument, thereby enhancing both its validity and reliability before full deployment.

3.4 Data Analysis Plans

Data analysis was conducted using IBM SPSS Statistics (Version 28 or later), following a structured plan: The initial phase involved Data Cleaning and Preparation. This includes checking for missing data and applying appropriate handling strategies (e.g., pairwise deletion for specific analyses, with missing ness reported), recording variables where necessary, and checking assumptions for parametric tests (normality, homogeneity of variance) Field, (2018).

Descriptive Statistics provided a foundational understanding. Frequencies and percentages will summarize categorical variables (demographics, adoption rates). Means, standard deviations, medians, and ranges will describe continuous and ordinal variables (Likert scale scores). Tables and charts (e.g. bar charts, histograms) visually represented key findings related to each research objective, such as the percentage adoption of ORCID/DOI or mean ratings of perceived challenges.

Chi-square Tests of Independence examined associations between categorical variables (e.g., association between ORCID adoption and Researcher Role; association between awareness of ROR and University).

Independent Samples t-tests compared mean scores (e.g., perceived benefits) between two groups (e.g., Researchers vs. Librarians; University A vs. University B, contingent on sufficient sample sizes).

One-way Analysis of Variance (ANOVA) compared mean scores across three or more groups (e.g., perceived challenges across the four universities; benefit perception across different role categories). If ANOVA results are significant, Post-hoc tests (e.g., Tukey HSD) will identify specific group differences.

Pearson or Spearman Correlation coefficients explored relationships between continuous or ordinal variables (e.g., correlation between level of PID awareness and perceived benefits; correlation between perceived institutional support and reported challenges).

Optionally, Multiple Linear Regression analysis may model the influence of multiple independent variables (e.g., role, experience, institutional support) on a key dependent variable (e.g., overall benefit perception score), while controlling other factors.

RO i: Frequencies/percentages for adoption of each PID type; Chi-square/ANOVA for differences by role/university.

RO ii: Mean ratings and rankings of challenges; frequencies reporting major challenges; ANOVA/t-tests for group differences.

RO iii: Mean ratings of perceived administrative actions/effectiveness; descriptive summaries of support mechanisms.

RO iv: Mean ratings of perceived benefits; ranking of benefits; correlation with adoption.

RO v: Frequencies/mean ratings of specific PID uses; identification of most common uses.

RO vi: Mean ratings of perceived opportunities; identification of most promising opportunities.

4. Results and Discussion

This chapter presents the findings of the study. This analysis examines survey responses from three Assistant Librarians across three Zimbabwean universities regarding Persistent Identifiers (PIDs) in research. The findings reveal high awareness of core PIDs (DOI, ORCID) but limited practical implementation, significant institutional and technical barriers, and strong belief in PID benefits despite adoption challenges. Key themes include the critical need for institutional policy development, enhanced training programs, and financial support to accelerate PID integration.

4.1 Respondent Profile

Table 1

Respondent	Institution	Role	Research Experience	Digital Tools Used
R1	University 1	Assistant Librarian	Not specified	Data Management Tools
R2	University 2	Assistant Librarian	6 years	Data Management Tools
R3	University 3	Assistant Librarian	6 years	Data Management Tools

Sample Characteristics: All respondents are information professionals with experience in research support services, providing qualified perspectives on PID implementation challenges.

4.2 PID Awareness Levels

Table 2: Mean Awareness Scores (1=Not Aware, 5=Very Aware)*

PID Type	R1	R2	R3	Mean
DOI	5	4	4	4.3
ORCID	5	4	4	4.3
ROR	4	4	4	4.0
Handle System	4	1	1	2.0
ARK	4	1	1	2.0
RAiD	4	1	1	2.0

Bar Chart – Mean Awareness Scores by PID Type: Shows overall awareness levels, with DOI, ORCID, and ROR scoring highest, while Handle System, ARK, and RAiD scored low. **DOI (Digital Object Identifier)**: Mean Score: **4.3.** All respondents indicated a high awareness level, with two scoring it a 5 and one a 4. This reveals that DOIs are widely recognized and understood as a critical PID in the research community. **ORCID**: Mean Score: **4.3** Similarly to DOIs, respondents are very aware of ORCID, indicating its significance for author identification and academic visibility.

ROR (Research Organization Registry). Mean Score: **4.0.** This is a huge score, but the pattern is somehow interesting. All three respondents rated it a 4. This suggests a consistent, solid level of awareness, but no one seemed to be "Very Aware." This suggests that ROR is crucial for affiliation disambiguation but is often a "back end" identifier that researchers encounter indirectly (e.g., in manuscript submission or grant applications) rather than daily use. **ROR (Research Organization Registry).** Mean Score: **4.0:** A solid awareness level reveals that respondents understand the role of ROR in identifying institutions, though there may still be room for improvement in broader recognition. **Handle System**: Mean Score: **2.0.** This score suggests: low awareness, particularly from R2 and R3, who rated it only a 1. This suggests a huge gap in understanding of the Handle System's function and relevance. **ARK (Archival Resource Key)**: Mean Score: **2.0** Like the Handle System, awareness is low. This suggests that more education is needed regarding ARK as a tool for persistent identification of digital resources. **RAiD (Research Activity Identifier)**: Mean Score: **2.0 .** Low awareness here as well suggests a similar need for outreach and training related to RAiD, highlighting its potential benefits or uses in research activity tracking.

4.2.1 Awareness and usage Levels by PIDs Respondents

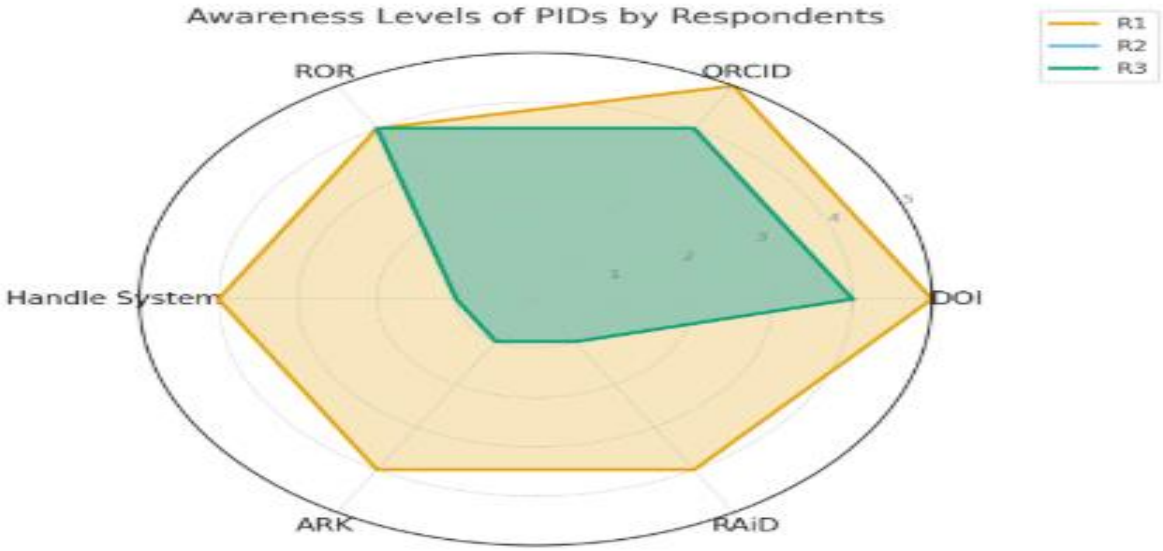

Figure 1: Radar Chart – Awareness Levels of PIDs by Respondents: Compares individual responses (R1, R2, R3) across different PID types

Key Insight: High familiarity with mainstream PIDs (DOI, ORCID, ROR) but limited awareness of specialized identifiers, indicating opportunity for broader education.

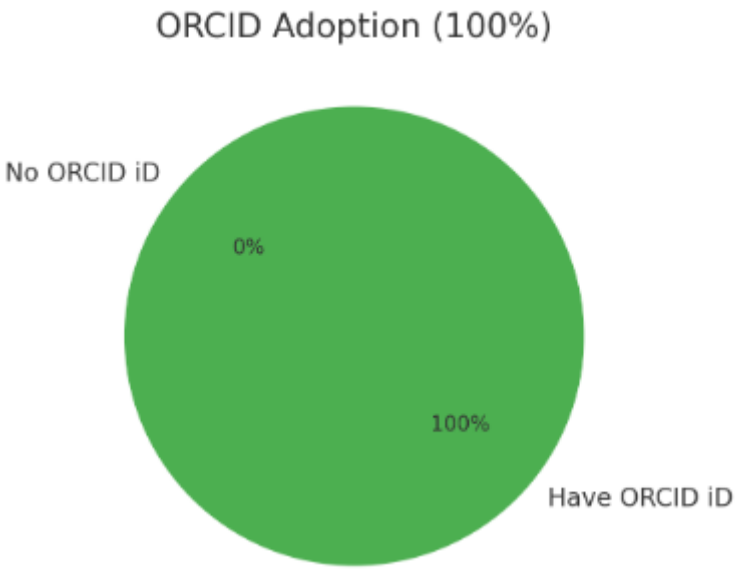

Figure 2: Pie Chart – ORCID Adoption (100% adoption across respondents).

4.2.2 University Administration Performance

Table 3: Institutional Support Assessment (1=Strongly Disagree, 5=Strongly Agree)*

Administrative Function	R1	R2	R3	Mean	Performance
Clear PID policies	1	3	3	2.3	Poor
Policy communication	1	3	3	2.3	Poor
PID system integration	1	3	3	2.3	Poor
Technical support	2	2	2	2.0	Poor
Financial support	1	2	2	1.7	Very Poor
PID advocacy	2	2	2	2.0	Poor

Clear PID Policies: Mean Score: **2.3** (Poor). These confirm that there is a lack of well-defined policies regarding PIDs, indicating a significant gap in institutional guidance. **Policy Communication**: Mean Score: **2.3** (Poor) Similar to policy clarity, communication about existing policies is not enough, leading to potential confusion among stakeholders. **PID System Integration**: Mean Score: **2.3** (Poor). The integration of PID systems within institutional frameworks is poor, suggesting that there are challenges in effectively incorporating PIDs into existing processes. **Technical Support**: Mean Score: **2.0** (Poor) Low technical support implies that institutions are not providing enough resources or assistance to facilitate PID usage, which can hinder adoption. **Financial Support**: Mean Score: **1.7** (Very Poor). This is the lowest score, suggesting a critical lack of financial resources allocated for PID initiatives. This may severely limit the ability of researchers and institutions to adopt PIDs effectively. **PID Advocacy**: Mean Score: **2.0** (Poor) Low levels of advocacy for PIDs indicate that there is insufficient promotion and encouragement from the administration, which is critical for fostering a culture of PID usage. **Institutional Gap:** Significant deficiencies in policy development, resource allocation, and support systems.

Qualitative Thematic Analysis

Theme 1: Institutional and Policy Deficiencies

Prevalence: Cited by all respondents as the primary barrier

a. *"Lack of policy"* (R1)
b. *"Lack of adequate policies and support"* (R2/R3)
c. *"Weak institutional research policies will slow down adoption"* (R2/R3)
d. *"Lack of funds and clear policies to enforce adoption"* (R2/R3)

"Lack of policy" (R1). This clearly captures the essence of the whole matter. Without a foundational policy framework, the adoption of PIDs is likely to be poorly guided.

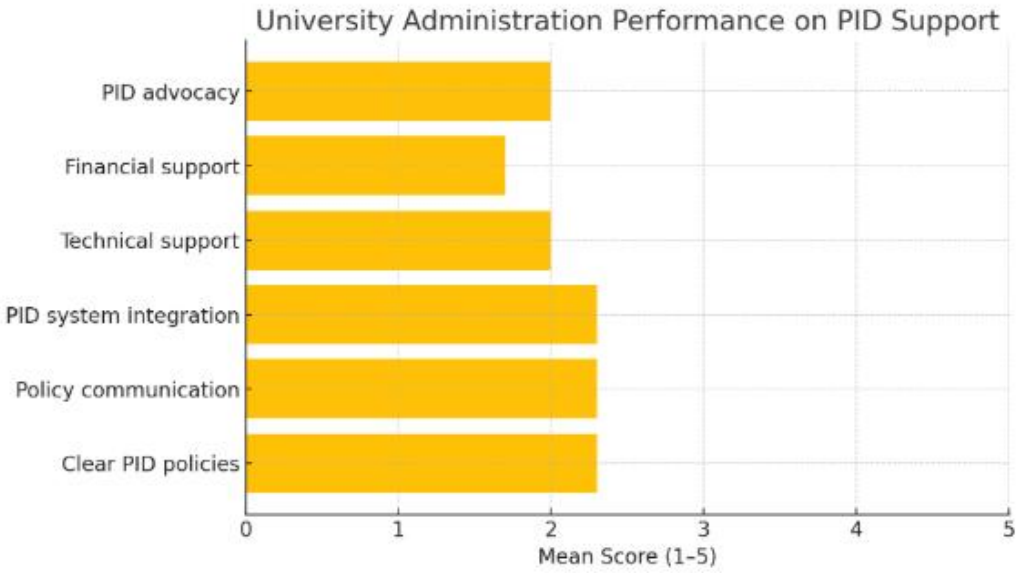

Figure 3: Horizontal Bar Chart – University Administration Performance (poor to very poor across all support areas)

4.3.1 Current PID Usage

a. **ORCID Adoption:** 100% (3/3 respondents have ORCID iDs)`
b. **Institutional ROR IDs:** Mixed awareness (1 yes, 1 no, 1 don't know)
c. **Usage Frequency:** Predominantly low engagement:
    i. Publishing: Rare to occasional use
    ii. Data Sharing: Never used
    iii. Grant Applications: Never used

100% Adoption (3/3 respondents): This indicates a strong commitment to using ORCID iDs among the respondents. ORCID IDs are critical for maintaining a unique identity in research, and their adoption suggests a common understanding of their importance in enhancing visibility and ensuring proper work attribution. Pertaining the use of Institutional ROR IDs. The responses reveal varying levels of awareness about ROR (Research Organization Registry) IDs, with one respondent confirming awareness, another denying it, and the third unsure. This mixed awareness suggests that that while some individuals are informed about the benefits of ROR IDs for institutional identification and data interoperability, there is a need for increased education to ensure all researchers understand their significance.

4.2 Perceived Benefits of PIDs

Table 4: Agreement Levels (1=Strongly Disagree, 5=Strongly Agree)*

Benefit Statement	R1	R2	R3	Mean
Increase visibility & discoverability	4	5	5	4.7
Enhance trustworthiness & credibility	4	5	5	4.7
Improve collaboration opportunities	4	5	5	4.7
Reduce authorship ambiguity	4	5	5	4.7
Facilitate research evaluation	4	5	5	4.7
Support FAIR data principles	4	5	5	4.7
Preserve research long-term	4	5	5	4.7
Enhance administrative efficiency	4	5	5	4.7

Consensus: Strong agreement (mean 4.7/5) across all benefits categories, indicating unanimous recognition of PID value and therefore once the *concept* of PIDs is understood, their proposed advantages are highly compelling to the research community.

Theme 2: Recognized Benefits and Opportunities

Prevalence: Strong consensus on potential value

a. *"Better citation, improved findability"* (R1)
b. *"Easier identification and location of researchers, research work and research institutions"* (R2/R3)
c. *"Visibility is improved as these ensure permanent availability and accessibility"* (R2/R3)
d. *"Networking, data sharing, researcher visibility, promoting interdisciplinary research"* (R1)
e. *"Research funding in many instances requires researcher IDs"* (R2/R3)

The statements highlight the multifaceted benefits of Persistent Identifiers, including enhanced citation practices, improved visibility and accessibility of research, and the facilitation of networking and interdisciplinary networking. Furthermore, the potential requirement of PIDs for research funding underscores their growing importance in the academic sphere. By adopting PIDs, researchers can enhance their impact and engagement within the research community.

4.3 Challenges in PID Adoption

Table 5: Challenge Significance (1=Not Challenging, 5=Major Challenge)*

Challenge	R1	R2	R3	Mean	Severity
Costs of obtaining PIDs	5	3	3	3.7	High
Lack of institutional support/policy	5	4	4	4.3	Critical
Limited technical infrastructure	5	4	4	4.3	Critical
Privacy/data ownership concerns	5	3	3	3.7	High
No immediate perceived benefits	5	4	4	4.3	Critical
Confusion from PID fragmentation	5	4	4	4.3	Critical
Resistance to changing practices	5	4	4	4.3	Critical
Limited training/resources	5	4	4	4.3	Critical

Critical Barriers: Institutional, technical, and cultural challenges emerge as most significant as respondents; acknowledge that collecting PIDs comes with a large financial burden, making institutional, technical, and cultural issues the most important implementation barriers. There is broad agreement that the lack of institutional support policies is a significant issue, indicating the necessity of purposeful institutional practice development. Critical Severity Mean Score: 4.3; Inadequate technological resources are cited by respondents as a significant obstacle, emphasizing the need for infrastructure investment to facilitate PID usage. Respondents identify several critical challenges to PID adoption, including inadequate technological resources, lack of immediate benefits, PID fragmentation, resistance to change, and limited training. All highlight the need for investment in infrastructure, awareness campaigns, clearer guidelines, change management, and professional development.

Theme 3: Cultural Resistance and Awareness Gaps

Prevalence: Significant behavioural and perceptual challenges

a. *"Cooperation from researchers"* (R1)
b. *"Fear of the known, technophobia"* (R2/R3)
c. *"They think it's hard to understand"* (R1)
d. *"Limited adoption, infrastructure, funding, awareness and lack of policy"* (R1)

This suggests that successful PID adoption requires active engagement and buy-in from the research community. Resistance or lack of interest can hinder progress. This suggests that some researchers may be resistant to adopting new technologies due to anxiety and fears about complexity or change, which can create a significant barrier to uptake. This reflects a common misconception that PIDs are complex, which can draw back potential users. Addressing these perceptions is crucial for increasing adoption. The last statement highlights the interconnected nature of barriers, emphasizing that cultural resistance is compounded by inadequate support systems.

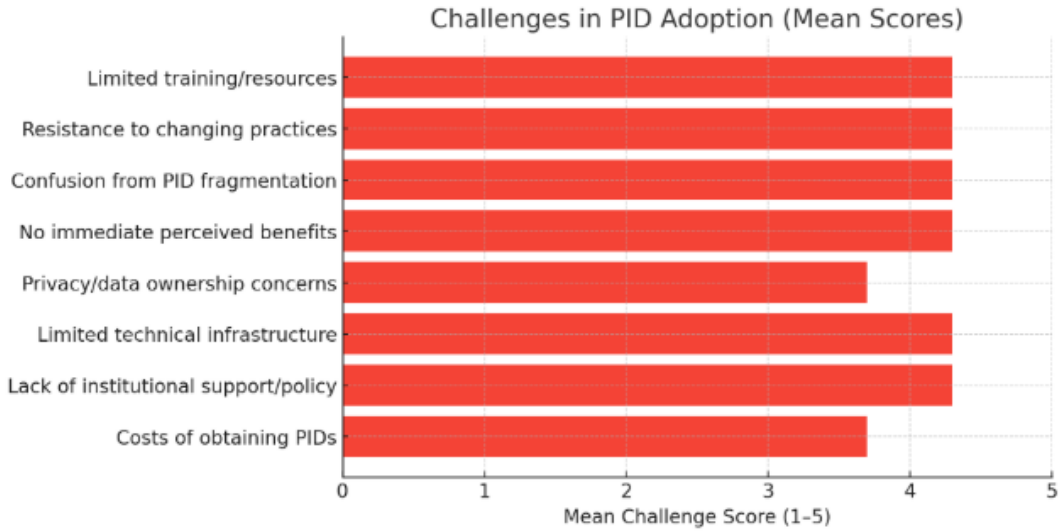

Fig 4: Challenges in PIDs adoption

Limited training resources, resistance to change, confusion by PID fragmentation, no immediate benefit, limited technical infrastructure, lack of institutional policy are the major challenges in pids adoption, though all mentioned challenges have high scores indicating the draw backs that, may be encountered in the implementation of PIDs.

Theme 2: Technical and Complexity Barriers

Prevalence: Universal concern about usability and infrastructure

a. *"System updates and changes, security issues, interoperability issues"* (R1)
b. *"Researchers who are not so techno savvy find it difficult"* (R2/R3)
c. *"Too technical and not easy to follow"* (R2/R3)
d. *"It is perceived by some that using PIDs is too difficult and time consuming"* (R2/R3)

Highlights ongoing problems that complicate the use of PIDs, affecting user confidence and system reliability. **Quote**: "Too technical and not easy to follow" and "using PIDs is too difficult and time-consuming" (R2/R3) Suggests that the perception of PIDs as cumbersome can deter engagement, underscoring the need for more intuitive systems and better user support. **Quote**: "Researchers who are not so techno savvy find it difficult" (R2/R3). Suggests that the complexity of PID systems can alienate less tech-savvy researchers, hindering adoption.

4.4 Mitigation of Challenges faced in the usage of Pids

Theme 3: Training and Support Needs

Prevalence: Consistent identification of capacity building requirements

a. *"Training can be done as soon as new staff come in, having awareness campaigns too"* (R1)
b. *"More training is required for researchers"* (R2/R3)
c. *"More workshops and personal training material"* (R2/R3)
d. *"More localized support and training"* (R2/R3)

This indicates that successful PID adoption requires active engagement and buy-in from the research community. Resistance or lack of enthusiasm can hinder progress and that some researchers may be resistant to adopting new technologies due to anxiety about complexity or change, which can create a significant barrier to uptake. The analysis reveals that cultural resistance and awareness gaps are critical challenges to PID adoption. The interplay of researcher cooperation, technophobia, and misconceptions about complexity creates a huge barrier.

5. Conclusion and Recommendations

5.1 Conclusion

On the perceived benefits and opportunities it was concluded Persistent identifiers significantly enhance research credibility and provide substantial opportunities to improve trust in scholarly communication, as well as increase visibility and accessibility.

Secondly the support from universities in critical areas for the adoption of persistent identifiers has been very poor. As a result, while some PIDs like DOIs and ORCIDs enjoy high levels of recognition and utility, others still require concerted efforts to enhance awareness and understanding among researchers. Although ROR is crucial for affiliation disambiguation, it is often viewed as a "back end" identifier. Addressing the educational gaps surrounding Pids like the Handle System, ARK, and RAiD is essential to fully leverage their potential benefits in academic and research activities.

The conclusion made on the challenges faced in the adoption of PIDs is that institutional support may reduce a multiplicity of challenges such as financial constraints and training facilities and no perceived benefits by catering for these challenges.

Successful adoption of persistent identifiers (PIDs) necessitates active engagement and training within the research community as well as necessary funding. The identified needs for timely training, localized support, and workshops highlight the importance of addressing cultural resistance and misconceptions. By fostering a supportive environment, institutions can overcome barriers to uptake and enhance PID adoption among researchers.

This analysis reveals a critical inflection point for PID adoption in Zimbabwean universities. While awareness and belief in PID value exist among information professionals, systemic barriers prevent realization of benefits. The pathway forward requires institutional leadership, targeted resource allocation, and collaborative engagement with research communities.

The unanimous recognition of PID benefits combined with identified implementation challenges provides a clear mandate for coordinated action to enhance research visibility, trust, and collaboration through persistent identifier adoption.

5.2 Recommendations

1. Recommendations to University administration may be as follows. Short-term (0-3 months): Develop a PID policy framework, mandate ORCID IDs, establish DOI assignments, and create an implementation roadmap. Medium-term (6-18 months): Launch a comprehensive training program for different user groups, integrate with research systems, and set up a dedicated support infrastructure. Long-term (18+ months): Secure sustainable funding, develop cost-sharing models, and implement incentive structures for PID usage and integration in evaluations.

2. In order to mitigate challenges faced in the use of PIDs it is recommendable to Foster a culture of advocacy for PIDs by engaging institutional leadership to promote their strategic significance. Organize campaigns and training sessions that emphasize their benefit as well as allocate more resources to establish a dedicated technical support team focused on PIDs. These teams should provide training, troubleshooting, and assistance to facilitate easier adoption and usage.

3. In order to realise some benefits and opportunities in usage of Pids it is critical to regularly gather feedback from researchers about their training and support experiences. Use this information to adapt programs and address specific concerns.

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